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Testing the Waters

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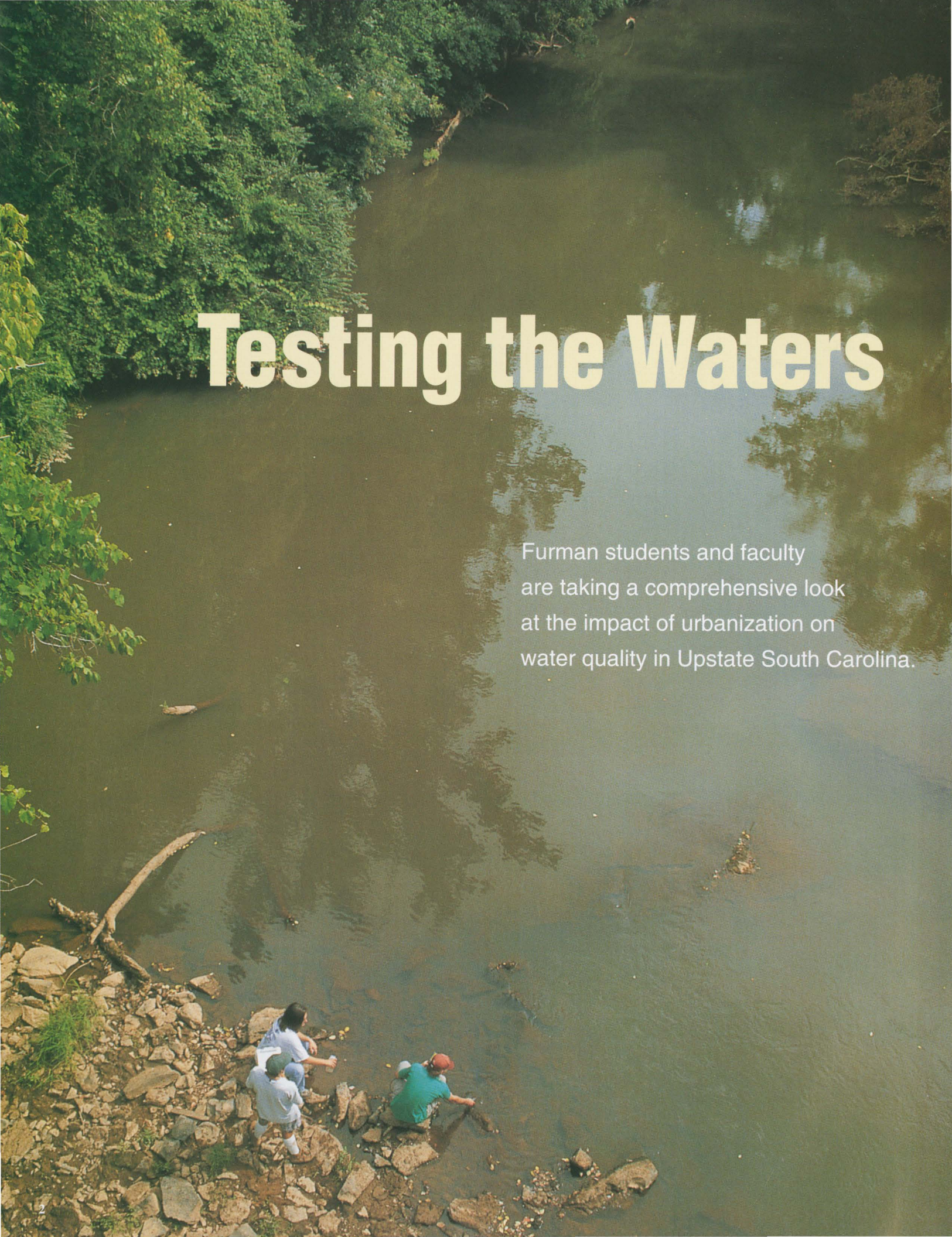
Furman students and faculty are taking a comprehensive look at the impact of urbanization on water quality in Upstate South Carolina.



By John Roberts

Named by the Cherokee Indians, the Enoree River means "river of muscadines." Like an oversized fish net, a rich-green grapevine drapes the trees along the banks of the meandering waterway.

From its origin at the foot of the Blue Ridge Mountains, the Enoree (pronounced EN-or-ee) winds southeast through four South Carolina counties before giving up its identity to the Broad River just north of Columbia. Along the way, the Enoree passes near urban areas and fast-growing suburbs. It is flanked by farmland and a protected national forest.

For the most part, the Enoree is an anonymous river, lacking both the size and notoriety of its sisters in the Upstate, the Reedy and the Saluda. Outside of boating enthusiasts or natives of the region, few have even heard of the Enoree.

But today, Furman student Chris Helps is making his way along a rural creek that feeds into the Enoree. Helps has hiked several miles through thick underbrush to reach this point. It's hot — about 90 degrees — and the biology major is wearing jeans, heavy boots and long sleeves for protection against briars and snakes. He kneels at the creek bed, wets a bandanna in the cool water and wipes his face and forehead.

The water looks inviting, and Helps is thirsty. But he does not drink. He knows better. Instead, he removes four bottles of varying sizes from a small backpack and dips each one below the surface. Later, back on campus, he will analyze the contents of the samples for nutrients, bacteria and other elements.

Helps' work represents just a tiny component of the River Basin Research Initiative, the largest, most comprehensive research effort ever undertaken by Furman.

While Helps and a team of students, some from other universities, examine the tributaries that feed the Enoree, another group — this one consisting of political science majors — investigates the population mix, political players, and private and public enterprises that impact the river. Sociology students poll residents in the area about their perceptions of the river, and economics majors work to determine how much residents are willing to pay to support preservation of the river.

With more than 30 students, 13 faculty members and six academic departments participating in the project, the watershed study is easily Furman's most extensive research endeavor. And it is breaking ground as one of the most comprehensive studies ever launched of the impact of urbanization on streams and rivers.

Next year Furman professors and students will present a summary of their findings to the South Carolina Department of Health and Environmental Control. While it is too early to release preliminary findings, researchers say the results of three years of water testing, analyzing, polling and interviewing will raise more than a few eyebrows. And it could impact future development and land-use regulations.

Undercurrent of change

On the surface, the Enoree has changed very little over the years. A canoe trip down the 61-mile river today is much as it was decades ago. The scenery, with the exception of a few new residential developments, has remained unchanged.

But just a few miles west and east of the Enoree, commercial, industrial and residential development has dramatically altered the landscape. While the population of the cities of Greenville and Spartanburg has remained relatively steady during the past 20 years, international investment and a vibrant economy have fueled explosive growth in outlying areas. During the past decade the population of the Greenville-Spartanburg-Anderson metropolitan statistical area increased 23 percent, according to the U.S. Census.

Much of that growth has occurred in the eastern and southern portions of Greenville and Spartanburg counties. Parts of Mauldin, Simpsonville and Greer, some of the fastest growing suburban towns in the nation (their population has doubled since 1990), are located in the watershed, a 725-square-mile region.

The River Basin Research Initiative, which began in 1996, has received nearly $600,000 in grants from various agencies and foundations. Above: Allen Mitchum uses a magnifier to identify a species of fish found in the Enoree River. (All photos by Charlie Register)

"Even though these fast-growing suburbs are not located on the banks of the Enoree, they are near creeks and streams that feed into the river, so they are in the watershed. The growth there impacts the Enoree," says Furman's Ken Sargent, an earth and environmental sciences professor who helps to coordinate the River Basin Research Initiative.

Despite barriers such as silt fences, the flurry of construction activity in the region muddies streams and rivers, which can have an adverse effect on the water quality and health of the ecosystem. As water-absorbing woodlands and farmland give way to subdivisions, roads and parking lots, natural water filters such as grass, brush and trees are lost. And the likelihood of flooding increases.

"In recent years, we've seen increased flooding in this area during heavy rains because there is not enough natural ground to absorb the water," says Sargent. "The water runs off pavement and ultimately into swelling creeks and streams."

While DHEC workers regularly monitor the Enoree — paying close attention to "point" polluters such as wastewater treatment plants that pump treated water directly into the river — the agency lacks the staff needed to test the hundreds of streams that empty into the river. So the Furman study offers a rare glimpse into the pollution level of these tributaries, says Douglas Fabel, the non-point source coordinator for DHEC.

"Our research is focused on understanding the relationship between land cover, stream chemistry and biodiversity," says Sargent. "We have shown that urbanization has fundamentally changed the biogeochemical cycles of silicon and nutrients, particularly nitrogen, and caused a general decrease in the biodiversity (aquatic insects and fish) of the streams."

Multiple perspectives

Furman EES, biology and chemistry students and faculty began the River Basin Research Initiative in 1996 with supporting grants from the National Science Foundation, Environmental Protection Agency, DHEC and the Rockefeller Brothers Fund. Excluding matching funds provided by Furman, the program has received nearly $600,000 in grants. Last year, the social sciences (political science, economics and sociology) joined the initiative.

"Few studies have looked at the social, economic and governance issues that contribute to the water quality of a region," says Sargent. "The physical sciences can only delineate the water quality problem. A social science perspective is also needed to convert the information into sound management policy."

Last summer, political science majors examined the political players and governmental agencies that could play a role in drafting legislation that would improve the river. They also outlined the hurdles such legislation might face, such as multiple jurisdictions and the perception by some that the river water is pure. Students also interviewed elected officials, members of residential groups, and officials with DHEC and the Army Corp of Engineers.

Sociology majors, meanwhile, helped compile and conduct more than 800 telephone interviews of residents living in the watershed. They asked questions about income, recycling habits and perceptions of water quality, and learned that 70 percent of the people polled felt that it was important to clean up the water. In addition, almost half of the residents correctly identified run-

Jason Felten filters debris from a water sample. Students representing six academic disciplines are contributing to the research project.

"Our students are writing about and presenting their research at conferences. Their research and presentations compare favorably to what many graduate students are doing."

off as the primary source of most river and stream pollution.

"The idea was to discover people's attitudes and behaviors as they relate to water quality and to use this information down the road in making policy," says sociology professor David Redburn.

Research conducted by economics majors determined that most residents in the watershed would support a $20 increase in their water bill to help clean up the river. The students also discovered that the higher a resident's income and education, the stronger the support for cleaning up the water.

Economics professor Ken Petersen, who helped coordinate the study, says the research found that young adults — those in their 20s and 30s — tend to place a higher value on water quality. In addition, by examining housing costs in the watershed, students were able to conclude that consumers value the river as a "non-traded commodity."

"All other things being equal, the closer to the river your house is, the higher its value," says Peterson.

Just the beginning

Such large research undertakings are unusual at state universities with graduate level programs. They are even more of a rarity at private, undergraduate liberal arts colleges.

"What makes this program unique is the interdisciplinary collaboration between the six departments, the size of the project, and the undergraduate focus," says Sargent. "Our students are writing about and presenting their research at conferences. Their research and presentations compare favorably to what many graduate students are doing."

In April, Helps' presentation titled "A study of body morphology and microhabitat use of several fish species in the Enoree River Basin" won second place at the meeting of the Association of Southeastern Biologists in New Orleans. He was one of just a handful of undergraduates competing in a 93-student field.

"It really was amazing to do so well, especially considering the competition," says Helps. "It helped me to realize and appreciate the value of my research."

Two other students, chemistry major Louise Parsons and EES major Leslie Shaver, won the best student poster presentation award at the meeting of the Southeastern Section of the Geological Society of America in Raleigh.

But aside from the research opportunities it affords, the River Basin Initiative gives future geologists, biologists, economists, sociologists and chemists a powerful introduction to the needs and requirements of research. And many discover that research and data collection can be monotonous and grueling.

"It's a lot of hard work," says Helps, who is planning a career in fisheries management. "But it can be rewarding when you know that you are breaking new ground. I hope what we are doing here today will make a difference in people's lives down the road."

And it's benefiting more than Furman students. Last summer undergraduates from Notre Dame, Trinity, Elon, Muskingum, Centre, the University of the South and Hendrix — most of them biology, chemistry and EES majors — joined Furman students in the project. This summer, students from Erskine, Birmingham Southern, Centre, Trinity, Eckerd, Northwestern, Pomona and The Citadel will be a part of the research team. Five students from the Universidad Metropolitana in San Juan, Puerto Rico, will also participate.

Sargent says collaborating with students from other colleges and different academic disciplines helps researchers expand their horizons.

"We have economics, chemistry, biology, earth and environmental sciences, sociology and political science majors all working side by side on the same project," he says. "Often the sciences will take a narrow, specialized approach, but this program has allowed our students to realize the big picture."

A discarded refrigerator provides a backdrop for Louise Parsons as she takes water-quality measurements with a conductivity meter.

This summer, the River Basin Research Initiative torch has been passed to a new group of 33 students. They will build on the research of their predecessors — collecting and analyzing more data, taking polls, studying demographics and environmental policy.

Sargent says the students will complete several studies that examine the relationship between land-use patterns and water quality. And they will continue to take water samples and study aquatic organisms in the streams.

"There are a lot of tributaries that we did not get to last year," he says.

Although the current focus of the River Basin Research Initiative is the Enoree and Saluda river basins, plans are in the works to expand the research to the nearby Seneca, Tyger and Pacolet watersheds.

Sargent says that the continued economic development in the region has made water quality a pressing issue throughout the region. He expects research in this field to become a staple of the summer research program at Furman.

"As long as there is economic growth in the area, the biology and chemistry of the water is going to change," he says. "And we're going to need to continue to monitor it."